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MISSISSIPPI VALLEY.

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SANITATION OF THE MISSISSIPPI VALLEY.

This subject is introduced at the present meeting of this association more with the object of awakening an interest in it among sanitarians, and to elicit a discussion on it at this meeting, than with the hope of doing it justice in the time allotted for the preparation of this paper, which was interrupted both by ill-health and business engagements. Presumably there are a number present who reside in this valley, both of the laity and medical profession, engaged in public health affairs, who are conversant with its sanitary defects and needs, and either directly or indirectly interested in all things pertaining to its welfare. Moreover, as the science of civil engineering enters so largely into the discussion of this question, it would afford an opportunity for gentlemen of that profession, members of this body, to give their views on this important subject. No section of country in America of the same extent offers a more interesting field for study to the sanitarian, or greater necessity for practical sanitation, than this; none more worthy of consideration as a question of political economy, involving larger interest as a question for state and national legislation. Take, for example, the vast area known as the Mississippi river bottom, lying between the 37th and 29th parallels of latitude, which would be from Cairo to New Orleans, or to the gulf coast, a distance of 500 miles direct, or about 1,000 miles by river, embracing a territory of 32,000 square miles, which includes, besides many other rich sections, the Yazoo delta of about 4,000,000 acres of alluvium, capable of producing as much corn and cotton, its staple products, as the same area anywhere else in the world. It is estimated that if this delta be completely protected from overflows and brought to its full productive capacity, it would yield about one half the present cotton crop of the cotton states, and corn enough to supply the labor necessary to its cultivation. There are other sections of the Mississippi delta and its tributaries as productive as this at present, only partially opened, heavily timbered, in some places covered by dense canebrakes, the richest of all lands, and interspersed with lakes and bayous as valuable as this, subject to the same obstacles to settlement. These lands are mostly alluvial bottoms, with some few exceptions, subject to annual overflows when not protected by levees, and full of all kinds of insect life incident to a damp, warm atmosphere, a heavy foliage, and dense undergrowth. While there are tracts of this

country open and in a high state of cultivation, with all the necessary comforts of living, many places that were once in cultivation, from force of circumstances have reverted almost to their original wild state, though new lands are constantly being opened, and the whole area in cultivation is now greater than ever before.

This whole country is the true habitat for all malarial diseases,—malarial fevers of every grade, from the ordinary intermittent to the hemorrhagic type, or malarial hæmaturia, as it is commonly called, which are phases of development of a chronic malarial toxæmia, characterized by structural changes of the constituents of the blood, the most difficult to treat successfully, and fatal type of malarial poisoning, and nearly all accompanied with more or less congestion and enlargement of the liver and spleen. A common sequela of this chronic malarial poisoning is an anæmic condition and dropsical effusion. Hepatitis, resulting in hepatic abscess, another sequela of the malarial toxæmia, occurs, perhaps, more frequently here than in any other locality in the country. This is not a metastatic abscess, the result of inflammation or suppuration in some other part of the body, or of traumatic injury or dysentery, which is sometimes associated with hepatic abscess, but a direct result of an abnormal condition of the liver caused as above stated. The pathology and therapeutics of these diseases not coming within the province of this paper, I will not discuss them.

These fevers are endemic throughout this whole section, and other diseases not peculiar to this locality are more or less complicated by the same influences causing them. There is a marked difference in the susceptibility to this malarial influence between the white and negro races. The former is much more susceptible than the latter, and do not stand exposure here so well during the summer and fall months. The negro race seems by nature peculiarly well adapted to this climate, and as a consequence constitute the great mass of the laboring population. In a paper read before this association on "Negro Mortality," in October, 1882, and published in vol. 8 of its transactions, I discuss this subject, and consequently will not dwell upon it now.

Owing to the facilities for transportation afforded by these great water ways, the Mississippi river and its tributaries, which are now supplemented by railroads, through commercial intercourse this valley, as other parts of the country, has been visited several times since its settlement by the two most destructive and dreaded of all exotic or importable diseases,—cholera and yellow fever. Neither has ever found a permanent lodgment in it, to be called into activity by any climatic conditions without fresh importation when once eradicated.

It is through this vast and important country that state medicine or public hygiene may demonstrate its greatest triumphs, and its devotees prove to the world the practical good claimed for it as a part of just state government and advanced civilization. The sanitation of this valley embraces three propositions,—the reduction to the minimum of the causes producing the malarious atmosphere, the improvement in the present

methods of living, thereby increasing the resistive powers of individuals to malaria, and the prevention of the introduction by importation of the infectious diseases above mentioned. The efforts made to prevent the importation of yellow fever along the gulf coast during the past four summers, I think, prove very conclusively that this disease can be kept out of the country by proper care and vigilance.

It has been demonstrated too often to admit of controversy, that large areas, formerly almost uninhabitable, have been so improved by drainage and cultivation as to be not only habitable but highly productive. Surface drainage, though essential through this whole delta, upon the largest scale, does not alone answer for drying the soil and removing the causes of malaria. The process of evaporation from a spongy and absorbent soil is too slow, when such an excess of moisture is to be disposed of during the hot season to prevent the atmosphere from being damp and humid. Much of this dampness can be prevented by lowering the ground-water by a system of underground drainage after the surface-water has been disposed of. Without going beyond our own country, or citing examples from either ancient or modern history, many of which could be given, I will mention the state of Indiana, with which doubtless some present are familiar, as affording a striking illustration of the beneficial results upon the public health of surface and underground drainage of wet and marshy districts. Many localities in that state, where malarial fevers prevailed to such an extent as to retard settlement, have been rendered healthy by thorough drainage for agricultural purposes. It is an open question whether or not extensive overflows cause an increased amount of sickness over those years not marked by such general and long-continued overflows. There is a difference of opinion among those who should be authority on this subject, and no records from which one year may be compared with another, to determine even with approximate accuracy the difference, if any, in the sickness following these extraordinary inundations.

My own opinion is, there is so much swamp land and malaria-producing element throughout this whole bottom country, independent of what are commonly called general overflows, that there is no material difference. Some years are more healthy than others, owing to a difference in atmospheric conditions, independent of their local conditions. For example, the summer of 1878 seemed to be particularly favorable to the spread of yellow fever through the whole valley country, and far beyond any influences of the malarial districts. This disease, that year, as is well known, extended to and spread rapidly through communities along the lines of railroads which were notably healthy, and free from local causes to produce disease. Dr. Stanford E. Chaille, of New Orleans, addressed a circular letter to a number of physicians in Louisiana after the great overflow of 1882, to ascertain if there was any marked increase of sickness in that state attributable to that overflow. His correspondents differed, but there was not sufficient evidence to justify the opinion that there was. He concludes his article as follows:—"In the meantime it

is satisfactory to find that the evidence thus far collected indicates that overflows do not cause, inevitably or generally, any notable increase of malaria, or any other disease, and that they certainly do not usually either cause or promote epidemics. Therefore the direct influence of overflows on health is not usually dreaded." *New Orleans Medical and Surgical Journal*, June, 1883.—Malarial diseases being preëminently the type which prevails most constantly through this whole delta, and which offers the greatest barrier to its development, the local sanitary work required should be such as would prevent or reduce to the minimum the influences causing such diseases.

There are no official statistics outside of a few cities in this valley, and they afford no adequate index to the general health conditions of the bottom country from which to obtain information as to the death rate or comparative loss of labor among the resident white and colored population from these diseases. They prevail mostly at a season of the year, latter part of summer and fall,—a season when the dews are heaviest, and exposure to them, for those whose work in the fields seems unavoidable, is attended with greatest danger. This is a period when labor is in greatest demand to gather the crop and perfect the year's work. The loss to the material wealth and possible resources of the country is not alone to be considered in estimating the death rate, but also in the great loss of time caused by enervating sickness at the most critical period of the year, when the greatest exhibition of endurance is required to resist this malarial poison.

The three conditions essential to the production of this malarial atmosphere are,—heat 67° to 70° Fr., a permament moisture, and vegetable decomposition, or emanations of a like deleterious character from the soil, paludal or marsh miasma; or, as it is more succinctly stated in Wood's Practice of Medicine, heat, moisture, and vegetable decomposition. Remove either element, and, the conditions being disturbed, malaria is not produced. At present these conditions prevail through this whole bottom country, modified or lessened in some localities by improvements, cultivation of the soil, and drainage.

The first essential step towards prophylaxis is to reduce to the minimum the two elements which are to some degree controllable; that is, the moisture and vegetable decomposition, or the miasmatic emanations from the soil. The seasons being immutable, the heat cannot be modified. Civil and sanitary engineering can so dispose of the water distributed over this country by the excessive spring floods and annual rain-fall, as in a measure to control this element. This would require an effective system of levees, canals, and reservoirs for holding back the water from the upper tributaries, and increased rapidity of the outflow of the Mississippi, thereby preventing or diminishing the dangers incident to the more tardy process of evaporation.

The third factor—decayed vegetable matter and the deleterious elements of a fresh soil—is in process of being removed by the constant clearing and cultivation of lands for agricultural purposes. The build-

ing of levees, draining bayous, lakes, and stagnant pools, and removing the deleterious ferments of the soil by cultivation, is a slow process toward the sanitation of this vast delta, though it is being done, and in course of time will no doubt be accomplished.

In the meantime it is well to consider the best methods for the preservation of health in the face of these opposing elements.

The resistance to malaria can be very materially increased by improved methods of living, over the existing methods among the masses of the people, and especially among those unacclimated.

The system can be so fortified as to resist much more effectively the depressing influences of this climate. By these methods are meant all the domestic comforts pertaining to good living. Wholesome food, properly cooked; pure drinking-water, which can only be obtained here by good cisterns; comfortable houses, two stories when practicable, and the upper rooms to be used as sleeping apartments; suitable clothing, a more general use of light flannels next the person, especially by those exposed to dampness; keeping out of the night air and the more malarious localities when the system is most impressible to this atmosphere; a strict observance of temperance in all things, especially abstinence from common whisky, the social beverage of this country. It is reasonable to suppose that a country of the natural fertility of this delta, settled as long as it has been, would be occupied by a population possessed of all the essentials requisite for good living, and observing those rules of individual hygiene best adapted to their surroundings. While there are those who possess all necessary domestic comforts, and observe those habits of life best for the preservation of health, and as a consequence experience as good health as others in more favored localities, this class is exceptional, and only proves the value of local sanitation and proper hygienic observances in individuals. To leave out of consideration this limited class, who may seek more salubrious localities when occasion demands it, it is so generally conceded as to justify the assertion that there are fewer home comforts enjoyed by the mass of the population of this valley than that of any of the same extent and value in the Union. The class of people who seem to me to be the greatest sufferers from climatic or local influence are the white laborers from Northern latitudes, generally Europeans employed by contractors to build railroads and levees through these bottoms. These people are unacclimated; their accommodations for sleeping are of the cheapest and most primitive character—indifferent log cabins or temporary rough board shanties—for convenience' sake located near their work. Their food is of a coarse character, poorly cooked. The drinking-water, one of the greatest essentials to good health, is taken from the bayous or lakes, and is full of organic impurities of themselves sufficient to cause sickness.

Memphis has afforded hospital accommodations for this class of people for years. Numbers of them seek relief there during the latter part of summer and fall, all affected in the same way, with violent remittent or intermittent fevers, sallow complexions, generally with enlarged livers

and spleens, and their symptoms characteristic of intense malarial poisoning, or, as it is commonly called by them, the "swamp fever." I am informed by a large contractor, of many years' experience as a railroad and levee builder in this bottom, that he cannot work to an advantage white labor after the advent of hot weather. Negroes are then the best: they seem by nature to be peculiarly well adapted to this country for all kinds of laboring work. One attack of malarial fever does not afford protection to the system from successive attacks, but there is a degree of acclimation, or the accommodation of the system to these climatic or paludal conditions, which has its value or influence in giving endurance, and affording to some extent powers of resistance. This may be attributable to the natural adaptability and instinctive promptings of man to accommodate himself to his surroundings, whether in an arctic or tropical latitude.

Now that congress has expended five millions of dollars to deepen the mouth of the Mississippi river for commercial purposes and to enable the largest class of ocean-going vessels to come up to New Orleans, and has recently made large appropriations to be expended under direction of its river commission for building levees to protect lands from overflow, as well as other engineering work for the protection of property from the caving of banks, this subject has more than a local interest.

These great annual inundations seem to be getting more formidable and difficult to control every succeeding year than formerly. This is due no doubt to the increased clearing of lands in the country above, which causes a more rapid melting of snows, and increased discharge of all upper rivers after the heavy rains of spring.

Protection from these great inundations is not only of vital importance to those residing and having all their interest in this valley, but becomes in a measure a national question, as no one state is able to cope with it as a whole; but all local sanitary work, such as draining of swamps, bayous, etc., should be done by state, county, and municipal authorities, who should likewise keep a proper record of vital statistics. The Hon. Mr. Ellis, of Louisiana, very justly said, in his speech before the 44th congress on this subject in advocacy of congressional aid for the protection of this delta, "Congress alone has that power."

This great delta is the geographical centre of the agricultural and commercial interests of this country, and, as a pure question of political economy, when protected and brought to a proper standard of public health, preservation by local sanitation will contribute more to the commerce and general wealth of the nation than any other equal extent of country in the Union. The practical question is, What are the best and most speedy methods for accomplishing this great work?

Civil engineers, who are alone competent to decide this, differ very widely on many points, but all seem to agree upon a general system of levees, supplemented by other plans as auxiliary.

Mr. A. G. Warfield, Jr., civil engineer, who accompanied the river commission above alluded to, submitted a report on this subject to the

congressional committee which had it under consideration, which in my judgment is the most exhaustive and able report yet made, and the study of which would repay any one interested in this question. His summary is briefly as follows:

1. Reservoirs at the head waters of the tributaries of the Ohio.
2. Straightening the channel by judiciously located cut-offs.
3. Closing of crevasses and bayous or forced outlets.
4. Erection of levees.

I herewith append tabulated statements from the signal service bureau, showing annual rain-fall and temperature from Cairo to New Orleans. This embraces the whole cotton belt of the Mississippi valley.

ANNUAL RAIN-FALL IN INCHES AND TENTHS.

	1871	1872	1873	1874	1875	1876	1877	1878	1879	1880	1881	1882
Cairo, Ill.	[29.0]	26.5	50.9	48.2	52.9	55.6	39.5	41.8	45.4	49.6	32.2	16.6
Leavenworth, Kansas	[49.0]	47.0	33.0	32.0	31.3	44.5	52.1	35.2	41.6	36.9	40.0	26.0
Ft. Gibson, Indian Ter.	[40.0]	[35.0]	39.3	38.9	44.1	31.5	46.8	13.1	33.1	30.5	37.8	38.0*
Memphis, Tenn. . .	[59.0]	44.0	56.2	44.1	57.0	55.5	73.5	49.3	52.3	61.7	42.8	71.0
Shreveport, La. . .	[55.0]	51.0	52.4	54.8	51.0	54.5	47.7	55.8	32.6	66.6	53.7	65.1
Vicksburg, Miss. . .	[60.0]	58.3	41.2	66.0	70.0	51.7	53.0	60.8	52.3	84.2	51.7	71.6
Fayette, Miss. . . .	[53.0]	[50.0]	[42.0]	44.0	65.8	56.4	72.2	58.5	54.4	72.0	55.4	[68.0]
Brookhaven, Miss. .	68.6	57.9	58.9	53.0	73.9	53.4	69.3	63.8	62.0	[75.0]	[66.0]	[70.0]
New Orleans, La.	64.5	64.0	70.0	61.0	85.5	67.2	63.1	66.2	51.3	69.8	64.0	50.2
Galveston, Texas . .	[42.0]	41.7	58.9	49.6	58.5	50.9	66.9	60.9	26.9	51.9	53.3	57.7
Mean	52.0	47.5	50.3	49.2	59.0	52.1	58.4	50.5	45.2	59.7	49.7	57.9

The above table is from "Signal Service Notes, No. VII," by H. A. Hazen, Computer Office, Chief Signal Officer. Edition 1883.

Records less than twelve months in above table are marked *; interpolated records are marked within brackets, thus: [59.0] for Memphis, 1871.

"The gradual increase of rain-fall during the past three years (1879–1882) is noticeable over a large extent of country, and not merely in a particular section." *Ibid*, p. 4.

D. T. FLANNERY, *Observer in Charge.*

Signal Office, Memphis, Tenn., Oct. 9, 1884.

TABLE I.

Mean Annual Temperatures.

STATIONS.	Year ending September 30.			Year ending June 30.							
	1872	1873	1874	1875	1876	1877	1878	1879	1880	1881	1882	1883
Cairo	57.3	55.7	58.4	56.3	58.3	56.2	61.1	59.1	62.1	70.8	61.5	. . .
Memphis	62.2	58.5	61.6	60.8	61.6	59 4	62.4	61.3	63.9	71.9	64.5	. . .
Vicksburg	66.4	64.7	67.5	65.6	66.5	63.7	66.3	65.8	68.1	70.1	68.7	. . .
New Orleans . . .	68.6	67.6	69.5	69.3	69.5	67.8	69.3	69.0	71.4	70 8	72.0	. . .

NOTE. Data for Table I taken from Annual Reports Signal Offices.

TABLE II.

Mean Monthly Temperature, being the Means of Ten Years, 1871 to 1880.

Stations.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Cairo	38.8	41.4	48.4	58.3	68.3	75.0	80.0	77.5	69.2	59.1	45.8	38.6
Memphis	42.6	44.9	52.6	60.8	70.5	77.5	81.8	78.8	70.7	60.6	49.0	42.4
Vicksburg	50.0	52.0	59.7	64.6	73.6	79.3	82.1	79.7	74.0	64.1	54.9	50.0
New Orleans . . .	55.8	57.2	63.7	68.3	75.3	80.8	82.6	81.9	78.0	69.3	61.1	55.2

NOTE. Data for Table II taken from Signal Officer's Report, year 1882.

TABLE III.

Mean Rain-Fall in Inches and Hundreds, Period same as Table II.

Stations.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
Cairo	4.47	3.33	4.73	4.34	3.84	4.95	3.68	3.19	2.46	3.22	3.86	3.47
Memphis	5.44	4.59	6.08	7.25	4.13	5.58	3.11	3.64	3.00	3.39	4.48	3.77
Vicksburg	4.27	4.60	7.51	7.90	5.26	4.32	3.54	3.73	4.44	3.00	5 68	5.13
New Orleans . . .	4.30	4.85	6.84	6.35	5 83	5.81	7.53	5.76	5.07	3.39	5.70	4.95

NOTE. Data for Table III taken from Annual Report Chief Signal Officer, 1882.